

# Agro-biological and technological characteristics of four Cabernet Franc (*Vitis vinifera* L.) clones grown in Republic of Macedonia

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## Abstract

Agro-biological and technological characteristics of four Cabernet franc clones (R9, 331, 332 and 327) were cultivated on collection vineyards in the Institute of Agriculture in Skopje's winery, Republic of Macedonia. These four clones were studied during the period between the years 2005 and 2007. The purpose of this research was to compare the agro-biological and technological characteristics of the four Cabernet Franc clones. They were cultivated in the same agro-ecological conditions, which were treated with standard agro-technical and ampelotechnical measurements. We got different results for the examined parameters as a result of the variety of the clones and the ecological conditions during the years of the research. It was posited that the yield is the steadiest at the 331 Cabernet franc clone with variation factor of 11.64, while the biggest variation of 27.23 was noticed at the 327 cabernet franc clone. As to the chemical composition of must, the major sugar content was measured in the wines from the 331 clone, which were produced in 2005 and 2007, but there wasn't a significant difference in the content of the titratable acidity of the wines that were produced from different clones in different years of harvest. The wines from the harvest in 2007 have smaller alcohol content (11-12 vol%) than the wines from 2005 and 2006. The highest content of the total antocyanins was measured in the wine from the R9 clone during the all years of the research. This wine form the R9 clone characterizes with the highest average wine – tasting assessment of 17,5 points.

**Key words:** Cabernet franc clones, yield, sugar, total acids, alcohol, anthocyanins

## Introduction

In the world, especially in the big wine-growing countries as France, Italy, Australia and so on, it is worked on the upturning of the assortment with clone selection and production of plant material from variation with better quality like Merlot, Cabernet sauvignon, Cabernet franc etc. Studying the clones and getting more real knowledge about their agro-biological and technological characteristics it's of a great importance for their further distribution and cultivation. The clones from one variety differ from the population with a better quality of the grape and of the produced wines (ENTAV-INRA, 1995). Also, the clones have some different characteristics (yield, mass of the grape, sugar content, titratable acidity and anthocyanins), which is result of the variety of the clones and the influence of the conditions during the cultivation process. The selected Cabernet franc clones, which characterize with larger yield and grapes with higher mass, give wines less quality than the clones which didn't have so good characteristics (Mazza et al., 1999).

The four examined Cabernet franc clones can be found mostly in France, Italy and other European countries, which produce wines with recognizable flavor with fruits aroma,

bigger content of tannins, anthocyanins etc. This cultivar is cultivated in R. Macedonia, but until now its clones weren't examined. Because of that, the aim of this research was to find the agro-biological and technological characteristics of the clones R9, 331, 332 and 327, from the Cabernet franc, and also the chemical content and the aroma character of the wines that were produced from these four clones.

### Material and working methods

In this research we had four clones from the Cabernet franc breed, which were the clones 331, 332 and 329 from France and the clone R9 from Italy (Rauscedo).

The process of cultivation was a fruit-wall with two legged Guyot way of pruning, distance of planting of 2.5m between the lines and 1.3m between the grapevines in line with an optimal strain of 22 buds by grapevine. Regular agro-technical and ampelo-technical measures were applied. From each clone in the research, we used 30 vines or 3 repetitions of 10 vines.

From agro-biological characteristics we analyzed the yield in  $\text{kg/m}^2$ , and from the chemical content of the must (the sugar content and the total vinegars) and the quality by means of the chemical content and the wine-taste assessment. From the chemical content of the must, the content of the sugar is specified with refractometer, and the total amount of vinegars with titration of  $\text{n}/4 \text{ NaOH}$ .

From all of the clones, the grapes used for wine production were taken during the phase of technological maturity, and micro-vinification was done. Then it is sulfured with 80 mg/L  $\text{SO}_2$ , and the vinous yeast (ferment) *Saccharomyces cerevisiae* is added. After the end inclement fermentation, it is pressed and the wine that we get is put in vitreous balloons in order to complete the fermentation. The wines were poured off twice, and with every pouring the content of the  $\text{SO}_2$  was rectified. After the second pouring off, a chemical analysis of the wines was done with usage of I.O.V. (International organization of vine and wine) methods. The alcohol content and the extract were specified with the pycnometer method and the content of anthocyanins was specified with the spectrophotometry method (Standard ISO 5495, 1983).

### Results and discussion

Results about the quantity of the harvested grape from the examined clones are shown in the table 1.

Table 1 Yield of grape  $\text{kg/m}^2$

Clones	2005	2006	2007	2005/2007	CV%
R9	3.656	2.760	3.970	3.462	17.96
331	3.136	2.750	2.490	2.796	11.64
332	4.291	3.014	4.522	3.942	20.60
327	2.450	2.030	3.430	2.637	27.23

During the examination period (2005/2007), all of the clones were in the same conditions, but the largest average yield had the clone 332 ( $3.942 \text{ kg/m}^2$ ), and the smallest had the clone 327 ( $2.637 \text{ kg/m}^2$ ). After some years, the biggest variation was noticed at the clone 327 with variation factor of 27.23 and the clone 322, with a variation factor of 20.60.

In the second table are shown the results from the content of sugar and total anthocyanins in the must per breed/clone and per year. The content of sugar and total anthocyanins and their ration are one of the most important parameters, which are the basis for the assessment of the grapes quality for one breed/clone. The average sugar content in the must of the R9 clone is between 204 g/L and 213 g/L. Beside this, in 2005 all clones had

larger sugar content as a result of the smaller load eyelets carrying grapes, because the plantation is in the first year of harvest. These variations per year are statistically insignificant except about the clone 331 (CV% 11.86).

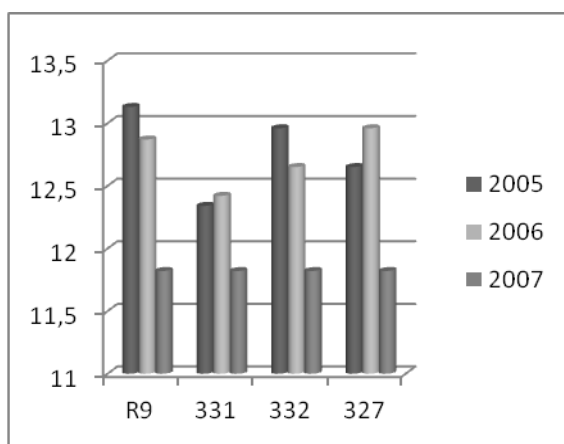
The average content of the total acids is from 6.0g/L at the clones 332 and 327 to 6.4 g/L at the clone R9. It is balanced during the years of the research and the differences are statistically insignificant (CV% from 1.64 for clone 332 to 4.76 for clone331).

Table 2 Content of sugar and total acids in the must (g/L)

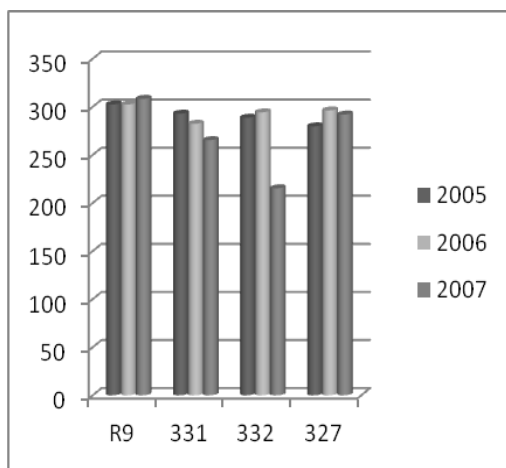
Clones	2005		2006		2007		2005/2007		CV%	
	sugar	TA	sugar	TA	sugar	TA	sugar	TA	sugar	TA
R9	218	6.3	199	6.7	196	6.3	204	6.4	5.84	3.59
331	228	5.9	184	6.4	226	5.9	213	6.1	11.9	4.76
332	210	6.1	204	6.2	217	6.0	210	6.0	3.09	1.64
327	226	6.2	202	6.0	201	5.7	210	6.0	6.75	4.22

Legend: T/A – total acids, CV%- variation factor

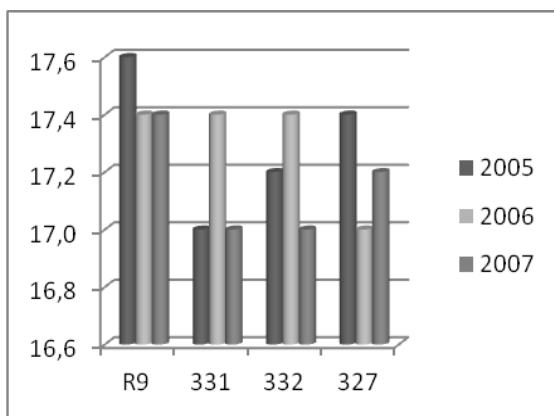
As to the alcohol content, it was posited that the wines have from 12.20 vol% of the clone 331 to 12.60 vol% of the clone R9. The wines from the harvest in 2007 have smaller alcohol content in ration with the wines from the harvest in 2005 and 2006. The reason for these differences is the smaller sugar content in the must from the grape in 2007.



Graph.1 Content of alcohol (vol%)



Graph.2 Content of total anthocyanins (mg/L)



Graph.3 Degustation rating (points)

One of the most important parameters for a red wine quality is the content of total anthocyanins, which depend of the breed, vine load, the level of grape maturity, the pressing, the length of the maceration, the temperature of fermentation and so on. It was posited that the wine from the clone R9 has largest content of anthocyanins (304.3 mg/L), and has a small variation during the years of the examination.

The smallest content of anthocyanins was measured in the wine from the clone 332 and it was posited that it has the biggest variation during the years of the examination. The wine-tasting assessment and the chemical analysis are the most important parameters, which give the quality to the wine. The wine-tasting points of the examined wines are given in the graph. 3.

Degustation grade of the wine is one of the leading characteristics and together with the chemical analysis determines the wine quality. Points from the degustation of the examined wine are presented in Graph.3. The average degustation grades are from 17.1 for the wine form clone 331, 17.2 (clones 332 and 327) to 17.4 points for the wines from clones R9. In the examination years, wines from clone R9 have high grading stability in terms of wine from the other three clones (331,332 and 327).

### Conclusion

On the basis of the results from the yield, sugar content and total acids in the must, the alcohol content and the total anthocyanins in the wine, the wine-tasting assessment, and their balance during the examination period, the cabernet franc clone R9 is the one that distinguish from the others. With this clone we will improve the quality of red wines in R. Macedonia with usage of the proper technology.

### Reference

- Balík J., Kumšta M. (2009). Evaluation of Colour Content in Grapes Originating from South Moravia. Czech Journal of Food Science, 26, S18–S24.
- ENTAV-INRA.(1995). Catalogue of Selected Wine Grape Varieties and Clones Cultivated in France. Ministry of Agriculture, Fisheries and Food. CTPS.
- International standard ISO 5495 (1983): Sensory analysis–methodology–Paired comparison test.1-6
- Jones G. V., Davis R. E. (2000). Climate Influences onGrapevine Phenology, Grape Composition,and Wine Production and Qualityfor Bordeaux, France. American Journal Enology and Viticulture, 51(3), 249-261.

- Lemoigne M., Maury C., Bertrand D., Jourjon F. (2008). Sensory and instrumental characterisation of Cabernet Franc grapes according to ripening stages and growing location. *Food Quality and Preference*, 19(2), 220-231.
- Mazza G., Fukumoto L., Delaquis P., Girard B., Ewert B. (1999). Anthocyanins, phenolics, and color of Cabernet Franc, Merlot, and Pinot Noir wines from British Columbia. *Journal of Agricultural and Food Chemistry*, 47(10): 4009-4017).
- Stefanini M., Porro D., Colugnati G., Voltolini J.A. (2003). Interactionc.v. Cabernet franc/terroir in Northeastern Italy. *Acta Horticulture (ISHS)* 603:627-632.
- The Catalogue selected wine grape varieties and clones cultivated in France. (2009). Eds.Boidron, R. etol. Ministry of Ag. Fisheries and Food.Pp 192-193
- The Catalogue Selected Wine Grape Varieties and Clones Cultivated in France (2001). Eds. Boidron, R. et al. Ministry of Ag. Fisheries and Food. pp 192-193.
- Yamane T., Jeong S.T., Goto-Yamamoto N., Koshita Y., Kobayashi S. (2006). Effects of temperature on anthocyanin biosynthesis in grape berry skins. *American Journal of Enology and Viticulture*, 57, 54–59.
- Van Leeuwen C., Friant P., Choné X., Tregoat O., Koundouras S., Dubourdieu D. (2004). Influence of Climate, Soil, and Cultivar on Terroir. *American Journal Enology and Viticulture* 55(3), 207-217.